AMENDMENTS TO THE DRAWINGS

Submitted herewith please find 12 sheets of drawings in compliance with

37 C.F.R. § 1.84. The Examiner is respectfully requested to acknowledge receipt of these

drawings.

The submitted drawings are intended to replace the drawings previously submitted on

October 20, 2005.

Attachment: Replacement Sheets (12 sheets)

REMARKS

Entry and consideration of this Amendment are respectfully requested.

Respectfully submitted,

Chid S. Iyer
Registration No. 43,355

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON DC SUGHRUE/265550

65565

CUSTOMER NUMBER

Date: December 29, 2006

5

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of   Docket No: Q90792

Masanao SUGA

Appln. No.: 10/553,986   Group Art Unit: 2629

Confirmation No.: 1007   Examiner: Unknown

Filed: July 8, 2006

For: NUMERAL VALUE DISPLAY SYSTEM

Substitute Specification with Marked Changes

DESCRIPTION

NUMERAL VALUE DISPLAY SYSTEM

[TECHNICAL FIELD]

The present invention is related to a numeral value display system capable of displaying numeral values whose digit number exceed such a digit number displayable on a display device, while operation feelings are not seriously deteriorated.

[RELATED ART]

Conventionally, in such a case that numeral values are displayed whose digit numbers exceed digit numbers displayable on numeral value display devices, there is no way other than such a method that, for example, a decimal number indication is changed into a hexadecimal number indication (refer to, for example, Japanese Laid-open Patent Application No. Hei-05-342163).

However, the conventional techniques own such a problem that operators can hardly understand, for example, hexadecimal numbers in an intuitive manner, and also another problem that this hexadecimal number indication may seriously deteriorate operation feelings.

The present invention is made to solve the above-described problems, and has an object to provide a numeral value display system capable of displaying a numeral value in an easily intuitively understandable

form by using a smaller digit number of a display device,
while operation feelings are not deteriorated.

[DISCLOSURE OF THE INVENTION]

To solve the above-described problems, according
to Claim 1 of the invention, there is provided with a
numeral value display apparatus including: a display
processing unit for reading a numeral value stored in
a storage member so as to control a display operation;
a numeral value display device for displaying information
derived from the display process unit; and an operation
key for switching the display of the numeral value display
device in a manual manner, a numeral value display system,
wherein in a case that the display processing unit executes
such an operation that the numeral value stored in the
storage member is read out to display the read numeral
value, if a digit number of the numeral value to be
displayed is larger than a displayable digit number of
the numeral value display device, the display processing
unit controls to subdivide the numeral value into a preset
digit number in order that such a fact that which numeral
portion of the numeral value to be displayed is displayed
can be grasped, and to display a portion of the subdivided
numeral values.

According to Claim 2 of the invention, there is
provided with the numeral value display system as in claim
1, wherein the operation key includes: at least one of

a left key and a right key; and the display processing unit includes: a member for setting a display unit variable which is required to control display positions of the numeral value every preset dividing digit number and for switching a digit portion of the numeral value based upon the display unit variable every time the operation key is depressed.

According to Claim 3 of the invention, there is provided with the numeral value display system as in claim 1, or 2, wherein the display processing unit includes: a member for incrementing the display unit variable when the left key is depressed; a member for decrementing the display unit variable when the right key is depressed; and a member for switching a numeral value portion to be displayed based upon the value of the display unit variable.

According to Claim 4 of the invention, there is provide with the numeral value display system as in claim 1, or 2, wherein the operation key includes: only the left key; and the display processing unit includes: a member for incrementing the display unit variable up to a preset maximum value when the left key is depressed and for changing the maximum value into "0"; and a member for switching a numeral portion to be displayed based upon the value of the display unit variable to display the switched numeral portion.

According to Claim 5 of the invention, there is

provided with the numeral value display system as in claim
1, or 2, wherein the operation key includes: both an up
key and a down key; and an editing digit variable required
to edit a portion of a numeral value which is displayed
on the display device every dividing digit number is set
to the display, the display processing unit includes:
a member for incrementing an editing digit when the up
key is depressed; a member for decrementing the editing
digit when the down key is depressed; a member for
incrementing an editing digit variable when the left key
is depressed; a member for decrementing the editing digit
variable when the right key is depressed; a member for
determining a value of a display unit variable based upon
the value of the editing digit variable; and a member
for switching a portion of a numeral value to be displayed
based upon the value of the display unit variable to display
the switched portion of the numeral value and for clearly
displaying the relevant editing digit.

According to Claim 6 of the invention, there is
provided with the numeral value display system as in claim
1, or 2, wherein the operation key includes: an up key
and a down key in addition to the left key; and an editing
digit variable required to edit a portion of a numeral
value which is displayed on the display device every
dividing digit number is set to the display, the display
processing unit includes: a member for incrementing an
editing digit when the up key is depressed; a member for

decrementing the editing digit when the down key is depressed; a member for incrementing an editing digit variable until the digit is reached to an uppermost order digit and for changing the uppermost order digit to 0; a member for determining a value of a display unit variable based upon the value of the editing digit variable; and a member for switching a portion of a numeral value to be displayed based upon the value of the display unit variable to display the switched portion of the numeral value and for clearly displaying the relevant editing digit.

[BRIEF DESCRIPTION OF THE DRAWINGS]

Fig. 1 is a structural diagram for showing a numeral value display apparatus which indicates a first embodiment of the present invention.

Fig. 2 is a flow chart for describing a display process operation.

Fig. 3 represents a display example (4 digits of lower order) of the numeral value display device.

Fig. 4 shows a display example (4 digits of middle order) of the numeral value display device.

Fig. 5 represents a display example (2 digits of upper order) of the numeral value display device.

Fig. 6 is a structural diagram for showing a numeral value display apparatus which indicates a second embodiment of the present invention.

Fig. 7 is a flow chart for describing a display process operation.

Fig. 8 is a structural diagram for showing a numeral value display apparatus which indicates a third embodiment of the present invention.

Fig. 9 is a flow chart for describing a display editing process operation.

Fig. 10 represents a display example (4 digits of lower order) of the numeral value display device.

Fig. 11 is a structural diagram for showing a numeral value display apparatus which indicates a fourth embodiment of the present invention.

Fig. 12 is a flow chart for describing a display editing process operation.

[BEST MODE FOR CARRYING OUT THE INVENTION]

Now, a description is made of a concrete embodiment of the present invention with reference to drawings.
[FIRST EMBODIMENT MODE]

Fig. 1 is a structural diagram of a numeral value display apparatus which indicates a first embodiment of the present invention.

Reference numeral 1 shows a numeral value display device, and reference numeral 2 represents one of display units which constitute the numeral value display device 1, and can display one digit of a numeral indication. Reference numerals 3 and 4 show a left key and a right

key which constitute operation keys respectively. Reference numeral 8 indicates a display process unit.

A feature of the present invention is given as follows:

That is, in a numeral value display apparatus comprising: the display processing unit 8 for reading a numeral value stored in a storage member (not shown) so as to control a display operation; the numeral value display device 1 for displaying information derived from the display process unit 8; and an operation key for switching the display of the numeral value display device 1 in a manual manner, in the case that the display processing unit 8 executes such an operation that the numeral value stored in the storage member (not shown) is read out to display the read numeral value, the display processing unit 8 is arranged to be controlled that if a digit number of the numeral value to be displayed is larger than a displayable digit number of the numeral value display device 1, then the display processing unit 8 subdivides the numeral value into a preset digit number in order that such a fact that which numeral portion of the numeral value to be displayed is displayed can be grasped, and then, displays a portion of the subdivided numeral values.

Also, while the operation key is arranged by both the left key 3 and the right key 4, the display processing unit 8 includes: a member for setting a display unit

variable "P" which is required to control display positions of the numeral value every preset dividing digit number, and for switching digit portions of the numeral value based upon the display unit variable "P" every time the operation key is depressed.

Also, the display processing unit 8 includes: a member (corresponding to steps S100 and S110 in Fig. 2, and will be explained later) for incrementing the display unit variable "P" when the left key 3 is depressed; a member (corresponding to steps S200 and S210 in Fig. 2, and will be discussed later) for decrementing the display unit variable "P" when the right key 4 is depressed; and a member (corresponding to steps S300, S410, S420, and S430 in Fig. 2, and will be explained later) for switching a numeral value portion to be displayed based upon the value of the display unit variable "P." The display process operation will be described in detail with reference to Fig. 2.

Fig. 2 is a flow chart for describing the display process operation.

While the display unit variable "P" takes 0, 1, 2 as the values thereof, when the display unit variable "P" corresponds to each of these values, 4 digits of a lower order are displayed; 4 digits of a middle order are displayed; and 2 digits of an upper order are displayed. Explanations of the display process operations every step are given as follows:

S100: In the case that the left key is depressed, the display process operation is advanced to a step S110. In the case that the left key is not depressed, the display process operation is advanced to a step S200.

S110: When "P" is smaller than 2, 1 is added to "P." When "P" is equal to 2, this "P" remains.

S200: In the case that the right key is depressed, the display process operation is advanced to a step S210. In the case that the right key is not depressed, the display process operation is advanced to a step S300.

S210: When "P" is larger than "0", 1 is subtracted from "P." When "P" is equal to "0", "P" remains.

S300: "P" corresponds to any one of "0", "1", and "2". When "P" corresponds to "0", the display process operation is advanced to a step S410. When "P" corresponds to "1", the display process operation is advanced to a step S420. When "P" corresponds to "2", the display process operation is advanced to a step S430.

S410: 4 digits of a lower order are displayed.

S420: 4 digits of a middle order are displayed.

S430: 2 digits of an upper order are displayed.

Fig. 3 is an example of such a case that 4 digits of a lower order are displayed as to numeral values of "12334567890" of 10 digits expressed by a decimal number. Reference numerals~~Numerals of~~ 5, 6, 7 correspond to an indicator for indicating that which numeral portion of the numeral values is being displayed. When 4 digits of

the lower order are being displayed, only numeral of "5"
is flickered, and reference numerals of both "6" and "7"
are turned ON. It should be understood that in this
drawing, a broken line indicates "flicker", whereas a
solid line shows "turn ON." Also, a combination of
reference numerals 5, 6, 7 also indicates that a portion
of the numeral value is being displayed presently. Since
the left key 3 is depressed, the display is switched to
a display of 4 digits of a middle order.

Fig. 4 is an example of such a case that 4 digits
of the middle order as to the numeral values of "1234567890"
are displayed. Only reference numeral of "6" is flickered,
and reference numerals of both "5" and "7" are turned
ON. Further, since the left key 3 is depressed, the
display is switched to a display of 2 digits of an upper
order.

Fig. 5 is an example of such a case that 2 digits
of the upper order as to the numeral values of 1234567890
are displayed. Only reference numeral of "7" is flickered,
and reference numerals of both "5" and "6" are turned
ON. Now, if the right key 4 is depressed, then a display
is made as shown in Fig. 4. When the right key 4 is again
depressed, then a display is made as indicated in Fig.
3.

Since the first embodiment is arranged as explained
above a portion of the numeral value having the layer
digit number than the digit number of the numeral value

display device is displayed, and since this displayed portion of the numeral value is switched, the base of the display need not be changed. As a result, there is no opportunity that the display of the portion of the numeral value can be hardly understood by the operator, and further, the operation feelings are not considerably deteriorated.

It should also be understood that although the numeral value is divided into the three numeral values in the first embodiment, a numeral value may be alternatively subdivided not only by 3, but also by an arbitrarily selected number, depending upon a digit number of this numeral value and also a displayable digit number. Also, in the first embodiment, the indicator for indicating that which numeral portion of the numeral value is being displayed is realized by the three bars. Alternatively, the display form may be arbitrarily determined for instance, the indicator may be realized by employing a circle and a dot.

[SECOND EMBODIMENT]

Next, a description is made of a second embodiment.

Fig. 6 and Fig. 7 show a structural diagram of a numeral value display apparatus in the case that only a left key is provided, and a flow chart for describing process operations thereof, respectively.

The second embodiment owns a different point from that of the first embodiment. That is, while the operation

key is constituted only by the left key 3, the display processing unit 8 includes: a member (corresponding to steps S100 and S110 of Fig. 7 and will be explained later) for incrementing the display unit variable "P" up to a preset maximum value when the left key 3 is depressed and for changing the maximum value into "0"; and a member (corresponding to steps S200, S310, S320, S330 of Fig. 7, and will be discussed later) for switching a numeral portion to be displayed based upon the value of the display unit variable "P" to display the switched numeral portion.

A description is made of Fig. 7. While the variable "P" takes 0, 1, 2 as the values thereof, when the display unit variable "P" corresponds to each of these values, 4 digits of a lower order are displayed; 4 digits of a middle order are displayed; and 2 digits of an upper order are displayed. Explanations of the display process operations every step are given as follows:

S100: In the case that the left key is depressed, the display process operation is advanced to a step S110. In the case that the left key is not depressed, the display process operation is advanced to a step S200.

S110: If "P" is equal to 2, then "P" is changed to "0." In other cases, "1" is added to "P." The value of "P" is changed to 0→1→2→0 every time the left key is depressed.

S200: "P" corresponds to any one of "0", "1", and "2". When "P" corresponds to "0", the display process

operation is advanced to a step S310. When "P" corresponds to "1", the display process operation is advanced to a step S320. When "P" corresponds to "2", the display process operation is advanced to a step S330.

S310: 4 digits of a lower order are displayed.

S320: 4 digits of a middle order are displayed.

S330: 2 digits of an upper order are displayed.

Since the second embodiment is arranged as explained above, a portion of the numeral value having the larger digit number than the digit number of the numeral value display device is displayed, and since this displayed portion of the numeral value is switched, the base of the display need not be changed. As a result, there is no opportunity that the display of the portion of the numeral value can be hardly understood by the operator, and further, the operation feelings are not considerably deteriorated.

It should also be understood that although the above-explained embodiment has exemplified such a case that the operation key is the left key, the operation key may be alternatively realized by a right key.

[THIRD EMBODIMENT]

Fig. 8 is a structural diagram of a third embodiment of the present invention.

Reference numeral 1 shows a numeral value display device, and reference numeral 2 represents one of display units which constitute the numeral value display device

1, and can display one digit of numeral indication. Reference numerals 3 and 4 show a left key and a right key, respectively. Reference numeral 9 shows a display processing unit to which an editing digit variable is set. Reference numerals 10 and 11 represent an up key and a down key, respectively, which are used so as to edit a numeral value.

The third embodiment owns a different point from the first and second embodiments. That is, while the operation keys include the up key 10 and the down key 11 in addition to the left key 3 and the right key 4, an editing digit variable "d" is set to the display processing unit 9, and this editing digit variable "d" is required so as to edit a portion of a numeral value, which is displayed on the display device every dividing digit number. The display processing unit 9 includes a member (corresponding to steps S100, S110 in Fig. 9, and will explained later) for incrementing an editing digit when the up key 10 is depressed; a member (corresponding to steps S200, S210 in Fig. 9, and will be explained later) for decrementing the editing digit when the down key 11 is depressed; a member (corresponding to steps S300, S310 in Fig. 9, and will be discussed later) for incrementing an editing digit variable when the left key 3 is depressed; a member (corresponding to steps S400, S410 in Fig. 9, and will be discussed later) for decrementing the editing digit variable "d" when the right key 4 is depressed;

a member (corresponding to step S500 in Fig. 9, and will be explained later) for determining a value of a display unit variable "P" based upon the value of the editing digit variable "d"; and a member (corresponding to steps S600, S610, S620, S630 in Fig. 9, and will be discussed later) for switching a portion of a numeral value to be displayed based upon the value of the display unit variable "P" to display the switched portion of the numeral value, and also for clearly displaying the relevant editing digit.

Fig. 9 is a flow chart for explaining a display editing process operation. In this embodiment, a decision is made that which digit of a numeral value is edited based upon an editing digit variable "d", and then, a portion of the numeral value to be displayed is determined based upon the determined digit.

While the editing digit variable "d" corresponds to an editing digit position of a numeral value, if the numeral value corresponds to 10 digits, then ~~this numeral value~~the variable takes values of "0" to "9." A portion of the numeral value to be displayed is determined based upon the value of the editing digit variable "d." Explanations of the display editing process operation every step are given as follows:

S100: in the case that the up key is depressed, the display editing process operation is advanced to a step S110. In the case that the up key is not depressed, the

display editing process operation is advanced to a step S200.

S110: A numeral of a digit "d" is incremented.

S200: In the case that the down key is depressed, the display editing process operation is advanced to a step S210. In the case that the down key is not depressed, the display editing process operation is advanced to a step S300.

S210: The numeral of the digit "d" is decremented.

S300: In the case that the left key is depressed, the display editing process operation is advanced to a step S310. In the case that the left key is not depressed, the display editing process operation is advanced to a step S400.

S310: When "d" is smaller than 9, 1 is added to "d." When "d" is equal to 9, this "d" remains.

S400: In the case that the right key is depressed, the display editing process operation is advanced to a step S410. In the case that the right key is not depressed, the display process operation is advanced to a step S500.

S410: When "d" is larger than "0", 1 is subtracted from "d." When "d" is equal to "0", this "d" remains.

S500: If d<4, then "P" is set to "0." If 4< = d<8, then "P" is set to "1." If 8< = d, then "P" is set to "2."

S600: "P" corresponds to any one of "0", "1", and "2." When "P" corresponds to "0", the display editing

process operation is advanced to a step S610. When "P" corresponds to "1", the display editing process operation is advanced to a step S620. When "P" corresponds to "2", the display editing process operation is advanced to a step S630.

S610: 4 digits of a lower order are displayed. The display digit "d" is flickered.

S620: 4 digits of a middle order are displayed. A display digit (d-4) is flickered.

S630: 2 digits of an upper order are displayed. A display digit (d-8) is flickered.

Fig. 10 is a display example of such a case that an editing digit is equal to 2 as to numeral values of "1234567890" of 10 digits expressed by a decimal number. 4 digits of a lower order of the numeral values are being displayed. Reference numerals~~Numerals of~~ 5, 6, 7 correspond to an indicator for indicating that which numeral portion of the numeral values is being displayed, and a meaning of an indication is similar to that of Fig. 3. Reference numeral 12 corresponds to an editing digit, and is flickered. If the key 10 is depressed, then the numeral of the editing digit is increased. If the key 11 is depressed, then the numeral of the editing digit is decremented. If the key 4 is depressed, then the numeral of the editing digit is moved along a right direction. If the key 3 is depressed, then the numeral of the editing digit is moved along a left direction.

When the key 3 is depressed and then the editing digit exceeds 3, the display is switched to a display of 4 digits of a middle order.

Since the third embodiment is arranged as explained above, a portion of the numeral value having the larger digit number than the digit number of the numeral value display device is displayed, and since this displayed portion of the numeral value is switched, the base of the display need not be changed. As a result, there is no opportunity that the display of the portion of the numeral value can be hardly understood by the operator, and further, the operation feelings are not considerably deteriorated.

[FOURTH EMBODIMENT]

Fig. 11 is a structural diagram of a fourth embodiment of the present invention.

Reference numeral 1 shows a numeral value display device, and reference numeral 2 represents one of display units which constitute the numeral value display device 1, and can display one digit of a numeral indication. Reference numerals 3 shows a left key. There is no right key. Reference numeral 9 shows a display processing unit to which an editing digit variable is set. Reference numerals 10 and 11 represent an up key and a down key, respectively, which are used so as to edit a numeral value.

The fourth embodiment owns a different point from the first, second and third embodiments. That is, while

the operation keys include the up key 10 and the down key 11 in addition to one left key 3, an editing digit variable "d" is set to the display processing unit 8, and this editing digit variable "d" is required so as to edit a portion of a numeral value, which is displayed on the display device every dividing digit number. The display processing unit 8 includes a member (corresponding to steps S100, S110 in Fig. 12, and will explained later) for incrementing an editing digit when the up key 10 is depressed; a member (corresponding to steps S200, S210 in Fig. 12, and will be explained later) for decrementing the editing digit when the down key 11 is depressed; a member (corresponding to steps S300, S310 in Fig. 12, and will be discussed later) for incrementing an editing digit variable until the digit is reached to an uppermost order digit, and for changing the uppermost order digit to 0; a member (corresponding to step S400 in Fig. 12, and will be discussed later) for determining a value of a display unit variable "P" based upon the value of the editing digit variable; and a member (corresponding to steps S500, S510, S520, S530 in Fig. 12, and will be discussed later) for switching a portion of a numeral value to be displayed based upon the value of the display unit variable "P" to display the switched portion of the numeral value, and also for clearly displaying the relevant editing digit.

Fig. 12 is a flow chart for explaining a display

editing process operation. In this embodiment, a decision is made that which digit of a numeral value is edited based upon an editing digit variable "d", and then, a portion of the numeral value to be displayed is determined based upon the determined digit.

While the editing digit variable "d" corresponds to an editing digit position of a numeral value, if the numeral value corresponds to 10 digits, then this numeral value takes values of "0" to "9." A portion of the numeral value to be displayed is determined based upon the value of the editing digit variable "d." Explanations of the display editing process operation every step are given as follows:

S100: in the case that the up key is depressed, the display editing process operation is advanced to a step S110. In the case that the up key is not depressed, the display editing process operation is advanced to a step S200.

S110: A numeral of a digit "d" is incremented.

S200: In the case that the down key is depressed, the display editing process operation is advanced to a step S210. In the case that the down key is not depressed, the display editing process operation is advanced to a step S300.

S210: The numeral of the digit "d" is decremented.

S300: In the case that the left key is depressed, the display editing process operation is advanced to a

step S310. In the case that the left key is not depressed, the display editing process operation is advanced to a step S400.

S310: If "d" is equal to 9, then "d" is set to "0." If "d" is equal to any other numerals than 9, then 1 is added to d9. The value of "d" is changed into 0→1→2→....→8→9→0 every time the left key is depressed.

S400: If d<4, then "P" is set to "0." If 4< = d<8, then "P" is set to "1." If 8< = d, then "P" is set to "2."

S500: "P" corresponds to any one of "0", "1", and "2". When "P" corresponds to "0", the display editing process operation is advanced to a step S510. When "P" corresponds to "1", the display editing process operation is advanced to a step S520. When "P" corresponds to "2", the display editing process operation is advanced to a step S530.

S510: 4 digits of a lower order are displayed. The display digit "d" is flickered.

S620S520: 4 digits of a middle order are displayed. A display digit (d-4) is flickered.

S630S530: 2 digits of an upper order are displayed. A display digit (d-8) is flickered.

Since the fourth embodiment is arranged as explained above, a portion of the numeral value having the larger digit number than the digit number of the numeral value display device is displayed, and since this displayed

portion of the numeral value is switched, the base of the display need not be changed. As a result, there is no opportunity that the display of the portion of the numeral value can be hardly understood by the operator, and further, the operation feelings are not considerably deteriorated.

It should also be understood that although the above-described embodiment has exemplified such a case that the operation key is the left key, this operation key may be alternatively realized by the right key.

Also, similar to the first embodiment, in accordance with both the third embodiment and the fourth embodiment, the subdivision of the numeral value may not be limited only to the three subdivisions. Also, the indicator for indicating that which portion of the numeral value is displayed may not be limited only the three bars. Furthermore, the method for representing the editing digit may not be limited only to the flickering method, but may be realized by way of, for instance, an under line, or the like.

[Industrial Applicability]

As previously described, the present invention is useful as the system for displaying the numeral value in the drive control apparatus.